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Brief Communication: Cutmarks on a Plio-Pleistocene Hominid From Sterkfontein, South Africa

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ABSTRACT Cutmarks inflicted by a stone tool were observed on the right maxilla of Stw 53, an early hominid partial skull from Sterkfontein "Member 5" (South Africa). The morphology of the marks, their anatomical placement, and the lack of random striae on the specimen all support an interpretation of this linear damage as cutmarks. The location of the marks on the lateral aspect of the zygomatic process of the maxilla is consistent with that expected from slicing through the masseter muscle, presumably to remove the mandible from the cranium. Although radioisotopic dates are not available and relative faunal dating of the deposit from which Stw 53 derives is problematic, the morphology of the hominid skull suggests a Plio-Pleistocene age for the specimen. This therefore constitutes the earliest unambiguous evidence that hominids disarticulated the remains of one another. Am J Phys Anthropol 111:579–584, 2000.

The early hominid partial skull Stw 53 was discovered in the dolomitic cave of Sterkfontein (Gauteng, South Africa) by the late Alun Hughes, during P.V. Tobias's long-term excavation of the site (Hughes and Tobias, 1977). The specimen consists of nine individual pieces of the cranium and mandible, some of which were derived from a decalcified solution pocket and the remainder from hard, calcified breccia that forms the wall of the pocket. This excavated area is contained within "Member 5," a geological unit defined by Partridge (1978) and traditionally characterized by the presence of stone tools. The recent recognition of at least two distinct breccia types in "Member 5" and the distribution plots of diagnostic, in situ stone tool artifacts within the unit have led Kuman and Clarke (in press; Clarke, 1994; Kuman, 1994a,b) to support Vrba's (1985) suggestion that "Member 5" is temporally heterogeneous. The breccia type that contained Stw 53 is separated to the north by "an east-west-oriented band of travertine that is continuous in its western end with a stalagmite boss. This travertine band could either be part of a stalactite curtain formed over part of the [Stw 53 brec-

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cia], or, more probably, it could be the filling of a crack that developed in the [Stw 53 breccia] as a result of subsidence" (Clarke, 1994, p. 212). This breccia, unlike the other "Member 5" deposits, has not yet yielded any in situ stone tools (Kuman and Clarke, in press).

Radioisotopic dating of the Stw 53 breccia infill is not yet possible, and relative dating of the infill is tenuous, as the recovered macromammalian fauna does not preserve taxa that are very useful biochronologically (Table 1). Bovids were identified mostly on the basis of isolated teeth or partial toothrows, rendering taxonomic designation beyond tribe or genus, except in the case of *Makapania broomi*, impossible. Similarly, taxonomic identification of the carnivore remains was restricted to the genus level. *Theropithecus oswaldi* is known from the radiometrically dated Shungura Formation, with a first appearance datum of ca. 2.4 My (unit E-3) (Eck, 1987), suggesting a maximum age for the Stw 53 breccia. Finally, the taxonomic designation of the Stw 53 skull is in dispute. It has been assigned to early *Homo* (*H.* cf. *habilis*) by Tobias and others (e.g., Hughes and Tobias, 1977; Tobias, 1978; Howell, 1978) and more recently argued to be a "late example" of *Australopithecus* by Clarke (Kuman and Clarke, in press). Either classification of Stw 53 suggests broadly a Plio-Pleistocene age for the Stw 53 breccia infill.

TABLE 1. Stw 53 breccia large mammal faunal list[1,2]

Primates
Hominidae
Hominidae indet.
Cercopithecidae
Theropithecus oswaldi
cf. *Cercopithecoides williamsi*
Cercopithecidae indet.
Carnivora
Canidae
Canis cf. *mesomelas*
Viverridae
Suricata sp.
Hyaenidae
Chasmaporthetes sp.
Felidae
Felidae indet.
Artiodactyla
Bovidae
cf. Boselaphini
Gazella sp.
Makapania broomi
Damaliscus sp.
Alcelaphini indet.
Perissodactyla
Equidae
Equidae indet.
Hyracoidea
Procaviidae
Procavia antiqua
Procavia transvaalensis

[1] Based on Pickering (1999) and Turner (1997).
[2] Taxa listed were identified in a 764 piece faunal assemblage recovered from an area designated as the Stw 53 breccia, the breccia type from which the Stw 53 hominid skull was recovered. The Stw 53 breccia is distinct sedimentologically from other "Member 5" breccia(s) and is delimited spatially on its northern and western ends by a continuous band of travertine (Clarke, 1994). The southern boundary of the Stw 53 breccia is defined by the limit of excavation in that direction, while the eastern boundary is set by the eastern edges of the 1 yd^2 excavation grid units from which the various pieces of the Stw 53 skull were recovered (see plan views of the site in Kuman, 1994a; Kuman and Clarke, in press).

MATERIALS AND METHODS

Two independent analyses of bone surface modifications on the Sterkfontein hominid fossils were undertaken. One analysis was conducted on the sample available in 1986 by White and Toth (e.g., White, 1988; White and Toth, 1989, 1991) and one on the expanded Sterkfontein collection by Pickering in 1997–1998 (Pickering, 1999). All bone surfaces were examined macroscopically under strong, low incidence light and also with a stereo microscope at various magnifications. Bone surfaces on specimens that preserved modifications were cleaned with acetone and then molded with a silicone-based impression material. Epoxy resin casts of these molds were then prepared and examined under a scanning electron microscope (SEM) (see, e.g., Rose, 1983).

RESULTS AND INTERPRETATION

Three distinct sets of short striations were observed on the right zygomaticomaxillary specimen designated Stw 53c (Fig. 1). We interpret these striations as cutmarks inflicted by a stone tool such as a sharp flake edge. The superior cutmark set is the smallest, located in the depth of the zygomaticomaxillary incisura. It consists of a series of short, deep, anteroinferiorly oriented, horizontal subparallel striae. The second set is at the broken alveolar end of the specimen and covers an area approximately 1.5 mm wide and 3.0 mm long (Fig. 2). Its many subparallel striae are oriented along an anteroinferior to posterosuperior axis. This set

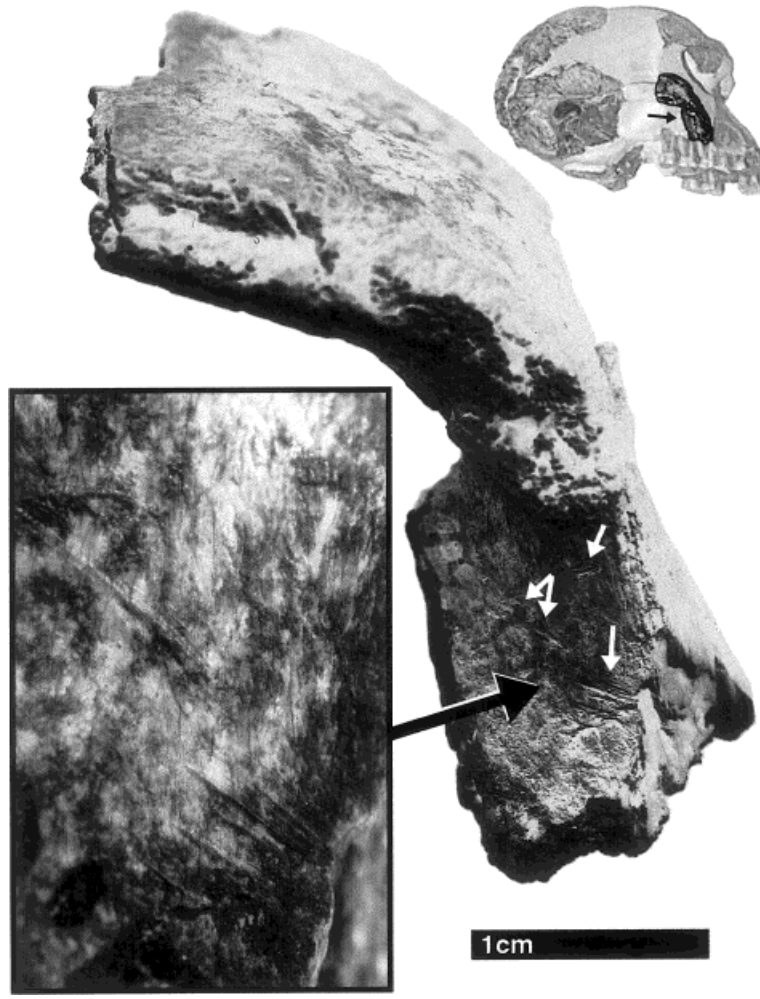

Fig. 1. Cutmarks on the hominid zygomaticomaxillary specimen Stw 53c. Stw 53c is seen in lateral aspect, with the cutmarks occurring on the inferolateral surface. Compare to the cutmarked hominid maxilla specimen from the Anasazi archaeological assemblage of Mancos (USA) (White, 1992, p. 194, Fig. 7.34). The inset shows a close-up of the main concentration of cutmarks.

was probably the result of several cutting strokes. The third set has fewer, but longer striae that are also oriented on a similar axis, but are at a steeper angle. Anatomical placement and directionality of the marks is consistent with that expected to result from slicing through the masseter muscle with a stone cutting edge. This is a cutmark pattern that has been demonstrated across a wide range of butchered mammalian species (Binford, 1981; Mark No. S-6 and references therein). We feel the most likely explanation for incision of the masseter would be for removal of the mandible from the cranium, and thus the cutmarks are best characterized as disarticulation damage.

The remaining 763 macromammalian fossil specimens, including the rest of the composite hominid skull, recovered from the Stw 53 breccia do not show butchery damage. Nor do any of these specimens display random striae (White, 1992). Of these specimens, 710 are nondental, with 84% preserving bone surfaces considered to be of fair to high integrity (Pickering, 1999). Scoring of the relative integrity of bone surface

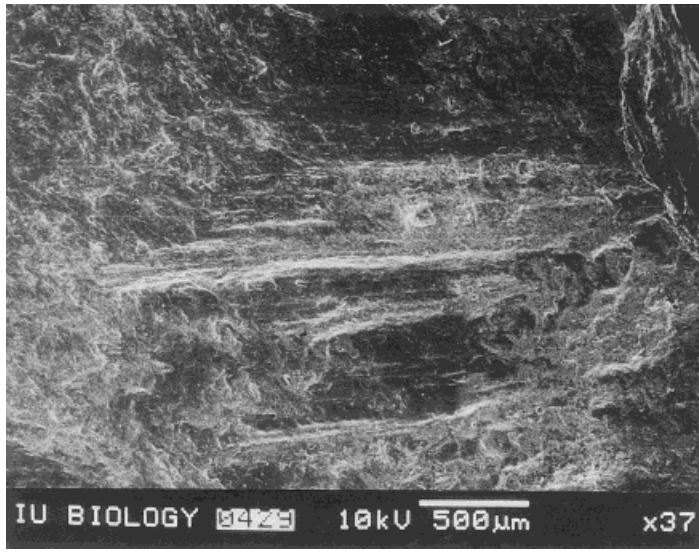

Fig. 2. Scanning electron micrograph of the main concentration of cutmarks on Stw 53c.

condition was a qualitative estimate of cortical exfoliation. Sterkfontein specimens with fair to high surface integrity display no or only minor exfoliation. Such specimens are comparable in loss of laminae to bones assigned to Stage 0 through early Stage 2 in Behrensmeyer's (1978) surface weathering scheme. Of these fairly well preserved nondental specimens, 97% had bone surfaces that were not obscured by adhering matrix (Pickering, 1999). Thus, the majority of fossil specimens from the Stw 53 breccia are nondental and are suitably preserved to maintain prehistoric surface damage if such damage was inflicted.

The marks on Stw 53c are not mammalian chewing damage. Only 28 specimens from the Stw 53 breccia display *definite* evidence of mammalian chewing (Pickering, 1999). This evidence includes both obvious damage, such as broad, shallow tooth scores and punctures, and also inconspicuous linear tooth damage as illustrated by Blumenschine et al. (1996). None of these types of damage have been observed anywhere on the Stw 53 composite specimen, and none can be confused with the more sharply angled and steeply sided, tool-induced striations found on Stw 53c.

Excavation and preparation activities are ruled out as having caused the linear damage preserved on Stw 53c. This part of the specimen was recovered from decalcified sediments, which made it unnecessary to employ the potentially more damaging excavation techniques required to remove fossils from consolidated breccia. Bone modifications that have been inflicted after fossilization are often a different color from normal bone surface and from regions damaged prior to fossilization (e.g., White, 1992; White and Toth, 1989). We did note minimal preparation damage on the Stw 53 composite specimen, concentrated on a crushed patch of the right temporal/parietal/occipital fragment. However, the striae floors on Stw 53c retain a color and patina consistent with the rest of the specimen's unmodified surface, demonstrating that the modifications are ancient, prefossilization striae.

Finally, the only plausible alternative to a stone tool having made the linear damage observed on Stw 53c would be unintentional abrasion of the piece against naturally occurring stones (e.g., White, 1985, 1992; Behrensmeyer et al., 1986, 1989; Fiorillo, 1989; Haynes and Stanford, 1984; Oliver, 1989). The lack of random striae on the more projecting, prominently exposed regions of Stw 53 and on the other fossils that preserve areas more susceptible to incision by sedimentary particles or stone outcrops argues against any hypothesis invoking trampling to explain the linear striae. The

anatomical fact that these striae traverse one of the most protected parts of the cranium is highly significant in this regard, as are the depths, nonrandom orientation, and discrete placements of these sets of striae (i.e., three sets, with different orientations).

SUMMARY AND CONCLUSIONS

Stone tool cutmarks on the Plio-Pleistocene hominid cranium Stw 53 have been identified in two independent studies of bone surface modifications on the Sterkfontein hominid fossils. Both studies employed a configurational approach (e.g., Binford, 1981; White, 1992) in the identification of this damage, taking into account the morphology of the striations, their anatomical placement on the fossil specimen, and the overall context of the cutmarked specimen within the macromammalian assemblage.

Until the present announcement, cutmarks on the Bodo cranium (Middle Awash, Ethiopia) were accepted as the earliest indisputable evidence of intraspecific, tool-assisted carcass reduction among ancient hominids (White, 1986). Although dating of the Stw 53 breccia is problematic, the morphology of the hominid skull, whether it be early *Homo* or late *Australopithecus*, suggests it is a representative of a species predating that represented by the ca. 600,000-year-old Bodo cranium and the cutmarked remains from Atapuerca's Gran Dolina TD6 (Fernández-Jalvo et al., 1999).

It is not possible to infer the reason(s) for the cutmarks observed on the Stw 53 hominid specimen. Reasonable hypotheses include cannibalism, curation, mutilation, and/or funerary procedures. The evidence presented here extends further into prehistory a pattern of postmortem manipulation of hominid carcasses by other hominids wielding stone tools. This pattern has become increasingly apparent in more recent stages of human evolution based on evidence from Pre-Columbian America (e.g., Turner, 1983; Turner and Turner, 1990, 1998; White, 1992), from the European Neolithic (e.g., Villa et al. 1986a, 1986b) and from the Pleistocene of Africa and Eurasia (e.g., Defleur et al., 1993, 1999; Fernández-Jalvo et al., 1996, 1999; White, 1986).

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